Implications of the social determinants of health and identifying effective community-based interventions to prevent and control infectious diseases in urban informal settlements in low- and middle-income countries: a systematic review

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Abstract

Background

The impact of rapid urbanization taking place across the world is posing variegated challenge. Especially in terms of communicable disease, the risk is more concentrated in urban poor areas where basic amenities are inadequate. In this context, the aim of this study was to carry out an evidence synthesis on the state-of-the-art effective community-based interventions in tackling infectious diseases among the urban poor in the LMICs across the globe.

Methods

This review has been registered in PROSPERO (CRD42021278689). A total of 18,260 published articles were primarily selected; after applying the inclusion and exclusion criteria 115 studies were considered for full-text screening. Among them, 17 articles were included. Afterwards, reference check was done and finally total of 21 articles were considered for the systematic review. Narrative synthesis was done.

Results

The pathway to identifying and addressing the SDOH through community-based intervention in the urban poor setting was complex. For effectiveness of a community-based intervention, the socio-cultural context is found extremely important. From this review, the effective community-based interventions were: community-based screening and socio-economic support, community-based vector control, behaviour change communication, capacity building of the Community Health Workers, health education and e-health interventions. Interventions need to be delivered considering the day-to-day realities of the urban poor. While some studies considered the outcome of specific diseases through vertical intervention approach, scarcity of evidence was found in terms of taking an intersectional approach.

Discussion

The effectiveness of an intervention are inextricable linked with social context, stakeholder dimensions and macro level social issues. The review results thus suggestive of an intervention package that considers a systems approach.

Conclusion

Considering this complex reality of an intervention to be effective, this evidence-synthesis therefore advocates for designing the intervention package with multiple components related to prevention and control of communicable diseases in poor urban areas.
PROSPERO registration number:

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Background

Over the last century urbanization has impacted the social and demographic characteristics of human being around the world [1, 2]. Currently half of the of world’s population resides across the urban areas, which is projected to rise to 70% by 2050 [3]. This urbanization is concentrated mainly in low-and middle-income countries and according to recent statistics, 90% of the urbanization takes place in Africa and Asia where economic growth cannot keep pace with the rate of urbanization [4]. While urban environment offers many opportunities and services, it concentrates health risks and introduces disproportionate hazards for more vulnerable groups, especially the poor living in informal settlements among whom food insecurity, inadequate housing and limited social protection pay a role in increasing the burden of disease [5, 6]. An urbanized place needs to have some specific characteristics to provide basic amenities and services to the urban people such as a municipal governance structure, infrastructural services, health services and economic activity to support the population. However, across the Low- and Middle-Income Countries (LMICS), the rapid and unplanned urbanization in a changing climate is characterized by substandard housing with weak infrastructure, unemployment and scarcity of basic services such as supply of food, safe drinking water, adequate sanitation, hygiene, etc. Besides, evidence suggests in the urban informal settlements there are also environmental exposure to pathogens, pollutants and chemicals, indoor and outdoor air pollution, inadequate food systems; and poor access to already inadequate health services [7, 8].

The Social and environmental determinants of health are inextricably linked to each other. These social, economic and environmental factors are the contributors to shape human behavior and influence the pattern of health, disease, and illness; for which they are referred collectively as social and environmental determinants of health (SDOH) [9, 10]. WHO defines the social and environmental determinants of health as a complete set of social and physical conditions where people live and work, including social, economic, demographic, environmental and cultural factors, along with the health system [11]. Due to the waning condition of the SDOH in urban informal setting, there is an aggravated risk of emerging and persistent infectious disease, particularly in LMIC countries [12]. For example, the recent COVID-19 pandemic has affected people around the world, but due to the informal nature, high population density, and poor housing infrastructure, the urban slums were disproportionately more vulnerable to the virus exposure and infection [13]. This is further evident from a COVID-19 seroprevalence study conducted in Bangladesh, which suggested that the seroprevalence of COVID-19 IgG and/or IgM was 45% in the Dhaka city whereas it was 74% in the slums [14]. Apart from COVID-19, the urban poor living in informal settlements are vulnerable to the spread of other infectious diseases like measles, chicken pox, influenza, tuberculosis, -which largely depend upon the ventilation facilities at the household [15]. Therefore, in order to inform the design of an effective intervention for the prevention and control of infectious diseases, including COVID-19, in urban informal settlements in LMICs, there is a need to recognize the heterogeneity
of the living conditions of urban poor and requires a broad multifaceted approach considering the SDOH [16, 17].

Across the LMICs, community-based interventions that put emphasis on grassroots participation from the community by enabling them in health-related decision making become popular from 1960s and early 1970s [18]. Such community-based interventions are still found to be cost-effective and scalable approach in terms of prevention and management of infectious diseases [19–22]. However, large majority of current community-based interventions are mainly directed toward disease-specific programs that takes a vertical approach [23]. Vertical approach refers to instances where a targeted health problem is sought to be solved through the application of a particular measure provided by single-purpose machinery [24]. A lot of these vertical approaches not tend to include a lens for analysing how power relations contribute to complex and multiple forms of health advantage and disadvantage. However, recent evidence suggest that taking an intersectional approach, has the potential to generate more useful and precise evidence to tackle health inequities and designing effective interventions to tackle infectious diseases [24, 25]. The intersectional approach is an analytical framework focuses on how multiple dimensions of social inequalities interact and intersect with each other at different level to co-construct the unequal health outcomes at individual and population level [25]. In addition, the Special Programme for Research and Training in Tropical Diseases (TDR) (Tropical Disease Research) has recently further defined an intersectional gender approach, by specifically encompassing a gender lens as the entry point for a deeper intersectional analysis. The intersectional gender approach analyzes how the gender power relations intersect with other social stratifies to affect people's lives and create differences in needs and experiences; with an aim to inform policies, services and programs for addressing those differences. [27].

However, there is dearth of knowledge on effective community-based interventions that take an intersectional gender approach to address the complex SDOH of infectious disease in urban poor setting in the LMIC. However, there are lack of evidence that analysed the community-based interventions, provided in urban areas of LMICs, through incorporating intersectional gender approach. Considering the important role of gender, there is a need for evidence on how the community based interventions design and implementation can be benefitted by taking intersectional gender approach. In this regard, evidence from LMIC settings considering the context of urban poor dwelling in this arena and learning the experiences of different countries will provide an opportunity to develop context-specific scalable interventions. This systematic review aims to understand the social determinants of health with an intersectional gender lens and identifying effective community-based interventions to prevent and control infectious diseases during COVID-19 pandemic in urban informal settlements in low- and middle-income countries.

**Methods**

This systematic review protocol was registered with PROSPERO (CRD42021278689). This systematic review has been conducted following the criteria of Preferred Reporting Items for Systematic Reviews and
**Expert consultation**

Considering the context and objective of the review, prior to start the initial tasks and developing search strategy accordingly, an expert consultation was performed to refine the preliminary research questions for the present systematic review through collation of feedback receive from stakeholders as well as Public Health experts, especially in the arena of infectious diseases, urban health, social determinants of health and evidence-informed health policy making. Stakeholders and experts from government bodies such as academicians from public university, from NGOs such as Sajida foundation and consultants working in Government institutions (IEDCR) and donor agencies (e.g. CDC, WHO, UNICEF) participated in this expert consultation programme. Besides, academicians from reputed private Universities in Bangladesh also accepted our invitation and participated as well. In addition, Healthcare professionals, researchers, academicians from Groningen University, University of South Carolina, University of Toronto, Sussex University, University of Sidney and McGill University and experts from World Bank-Cambodia, National Institute of Health) were included as target participants. A total of 20 experts were selected including both national and international experts from different relevant fields mentioned above. They were invited through e-mail for joining the consultation of question refinement. In order to do this, a concept note containing two initially proposed review questions was shared with them and they were asked to make comment on this and send their feedback through email. After that, the experts contributed in refining research questions and designing the review process.

**Eligibility criteria**

This review included intervention studies as defined by the Effective Practice and Organisation of Care (EPOC) group [29]. These studies include randomised controlled trials (RCT), non-randomised trials/quasi-experimental studies, cluster randomised trials, repeated measures studies, interrupted time series studies, and controlled before-after studies. Studies reporting any type of community-based intervention in preventing and controlling communicable diseases or evaluating the effect of community-based intervention on the communicable diseases among the urban poor in LMICs were included. Our primary review question was to find out effective community based intervention, among urban poor in LMICS, to prevent and control of infectious diseases. Once the effective community based interventions are identified, we will further analyse the interventions by incorporating a intersectional gender lens to find out what makes the intervention implementation effective in overcoming social, economic and gender inequalities.

Studies only published in English language was considered. The publication time of the review was limited to the period from 2011 to date (end of September 2021). The year 2011 has been selected as the World Conference on social determinants of health (SDOH), was held and created the ‘RIO political declaration’ on SDOH on this year [30].
Studies published as editorial, letter, opinions, brief communications or short report were excluded.

**Population**

The review included studies those were conducted in the settings among the urban (city, metropolitan city, city corporation, municipality) poor in the countries lying under Asia, Latin America and Sub-Saharan Africa region. Studies that report on the residents of slums, informal settlements or street dwellers in urban areas in the selected regions were included. No restriction was placed in terms of sex, age and ethnicity.

**Intervention:** This review considered studies focusing on any type of community-based intervention or programmes implemented by governments, NGOs, international organisations, research organisations or donor agencies for prevention and control of selected infectious diseases among the urban poor.

**Comparison:** No comparison was measured under this review.

**Outcome:** Incidence of the selected diseases was measured as main outcome. In addition to it, morbidity and mortality due to those selected diseases was also measured.

**Data sources and searches**

An updated and comprehensive search strategy was developed for MEDLINE covering a combination of electronic bibliographic databases (PubMed, Web of Science, Scopus), Cochrane Library, Google scholar and 3ie database of impact evaluations. Several relevant articles have been reviewed and cross-checked to assess the comprehensiveness of the search strategy. According to our review question, while building the search strategies, we did not take the intersectional gender approach. The intersectionality is rather a tool which we have used to analyse our 2nd review question.

In addition to those hand search and citation tracking has also be done.

**Study selection, and data extraction**

Screening and study selection was performed according to the selection criteria and the full manuscripts have been retrieved for closer examination. The inclusion criteria were then applied against the full text version of the papers independently by reviewers. Screening by title and abstract were conducted by dividing four team members into two groups. In each group, each team member individually screened studies by title and abstract individually and then the conflicts were resolved by discussing between those twos. Finally, the third reviewer has checked the screening result randomly to ensure the quality.

After completion of title/abstract screening, full text of the included articles from title/abstract screening were retrieved and two groups have screened the articles by reviewing full text maintaining same procedure as stated before at the title abstract screening phase. Full manuscripts of potentially relevant
studies were reviewed by two researchers against the eligibility criteria. Another two senior researchers will randomly check the included full text for data extraction.

Any kind of disagreement between reviewers regarding the decision on inclusion of articles has been resolved by detail discussion with the senior reviewers and consensus among the review team. Since the systematic review was conducted following PRISMA guideline, a flow diagram has been provided demonstrating the summary of all included and excluded articles.

All data extraction was verified by the review team members. Extracted data included some basic data such as author and publication year, study design, participants, intervention details and outcome assessed. Besides, all kind of relevant statistical data required to fulfill the objective were extracted.

**Quality assessment**

Two pairs of reviewers independently assessed the risk of bias using a checklist. Any uncertainties and discrepancies were resolved by discussion, further review of the respective study and consultations with a third reviewer, where necessary. Risk of bias assessment checklist was adopted from the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions and Effective Public Health Practice Project (EPHPP) checklist. In this review, ‘Blinding’ was not considered as a quality assessment criterion as blinding of participants or intervention implementers is rare in community-based intervention. The checklist followed in this review was also adopted and modified from the systematic review done by Hossain et al. (2017) [31]. Moreover, we categorized methodological components as “high/ “medium”/ “low” in terms of quality adopted from published systematic review [31]. The item of ‘random sequence generation’ and ‘allocation concealment’ were not considered in order to assess quasi-experimental study and cohort study included in this review.

**Data synthesis**

Meta-analysis was not possible to conduct due to significant heterogeneity regarding type of interventions, comparison groups, outcomes of interest, outcome measurement and statistical analysis. Instead, a descriptive analysis of study findings was done.

**Results**

**Study selection**

For this systematic review, a total of 18,260 published articles were selected and 1,028 duplicate articles were removed, providing 17,232 title and abstracts for review. After applying the inclusion and exclusion criteria, a total of 115 studies were considered for full-text screening. Among them, 98 papers were excluded after the full text screening and 17 articles were included. Reference check was done of all
included articles and additional 4 articles were included. Finally, total 21 articles were considered for the systematic review. Figure 1 provides a detail ‘Flow diagram’ for study selection process.

**Characteristics Of Included Studies**

The included primary studies were undertaken from 12 different countries worldwide those were published between 2011 and 2021 in peer reviewed journals. Among them, Bangladesh was being the most common setting (n = 5) followed by Pakistan (n = 3) and India (n = 3). By regional distribution, South Asian region was the common setting for 12 studies out of 21. According to the studies reviewed, most of the article's study designs were RCT (n = 7) and CRT (n = 6), few articles were quasi-experimental (n = 2) and cohort (n = 2) and two articles did not mention any study design. the predominant disease was tuberculosis (n = 7) and other diseases were diarrhea (n = 6), dengue (n = 3), influenza (n = 2) respectively. Other diseases such as pneumonia, Hepatitis-B, Hepatitis-C, and Haemophilus influenza, diarrhea & ARIs have one article each.

**Quality Of The Review**

The quality of this review was assessed and guided by two groups of Quality Assessment. Robust methods were adopted to minimize error and bias. A comprehensive systematic search of major electronic databases to identify studies. Additionally, references of included studies were checked. Randomized control trial and quasi experimental trial were considered to capture all varieties of intervention. Study quality and the risk of bias of included studies were assessed systematically following a quality assessment checklist adopted from the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions and published systematic review done by Hossain et al. (2017) [31]. More than half of the included studies (13 studies) were of high quality, only one study was low quality and the remaining studies were of medium quality. The review has several limitations that potentially influenced it. Most of the interventions are complex and designed with many components. It was difficult to indicate effectiveness of any component towards any significant changes in any outcome. Meta-analysis was not performed due to the absence of two or more studies within homogeneous intervention packages and effect size estimation to pool findings across studies. Additionally, synthesizing the findings of the studies was challenging due to the variations in the characteristics of the population, settings, intervention package. Another significant limitation of the review was the lack of detail in the description of intervention components in many studies (e.g. duration of training, number of training etc.). There is absence of sub-group analysis in these included studies which prevented drawing conclusions on the performance of specific group or providers engaged in the trials. This systematic review was limited to studies published in the English language only. However, there could be rich evidence published in other languages.

**Description Of Studies**
For this review, 21 studies identified as eligible to be included. Five studies were from Bangladesh, three studies were from India and Pakistan, two studies from Peru and we got one study from each of the countries named – Bolivia, Brazil, Cambodia, Chile, Kenya, Nicaragua, Thailand and Venezuela. Of the included studies 15 studies were designed as randomized controlled trial (RCT), 2 quasi experimental study, 2 cohort studies and 1 before-after trial (Table 1). Different types of interventions identified in this review focused different types of diseases; six studies focused on tuberculosis whereas another six studies highlighted diarrhoea following three studies focusing dengue and two studies focusing influenza. Different single study focused on pneumonia and Hepatitis-B. Two different studies included were identified where the interventions strategies targeted two diseases concurrently.

### Strategies Of Effective Community-based Interventions

A range of different techniques for community engagement were extracted from the reviews, however detail was generally sparse. Some studies included a quite broad terms such as – behaviour change intervention, health education, social mobilization etc. The other more specific approaches include socio-economic support, case detection and directly observed therapy (DOT) implementation, community-based screening, counselling, hand washing, water purification, community-based insecticide treated material (ITM) distribution and nutrition supplementation. It is mentionable that, no single approach was taken to combat with specific disease, combined approaches were identified. In the following parts we have reported the effective interventions identified from the review that addressed different diseases.

### Health Education

Across the reviewed studies, providing health education was identified as the most prevalent community-based intervention [32–35]. In different studies, health education was reported as effective intervention to address different types of diseases rather than any particular disease. Kaewchana et al. (2012) conducted an RCT where health education was provided to control influenza and its consequences as well [34]. This educational intervention was repeatedly provided to the household individual on hand washing technique and conveying messages such as “Why to wash”, “when to wash”, “how to wash” and “how hand washing is linked to influenza transmission”. This intervention was able to increase the frequency of handwashing in the intervention group (p < .001). In addition, findings showed that in comparison to pre-education and 90 days post education in the intervention group, the frequency was increased from 4.1 (SD = 2.7) to 5.6 (SD = 3.5). Intervention on hand washing techniques made significant improvement in the duration of hand washing (p < .001). It was self-reported by the participants that the frequency of their hand washing increased after using their hands to cover their mouth and nose when coughing, sneezing and blowing their nose and after touching any other surfaces that presumed secretion-contaminated (p < .001). These findings were identified as the strengths of educational approaches.
Kusuma et al. (2016) suggested the positive effect of health education on dengue prevention through a quasi-experimental study [32]. This study was conducted in slum population in Delhi where health education was provided through the materials such as pamphlets, posters, banners and audio message recordings. Findings showed that, health education made positive impact in increasing awareness about 20% about the illness caused by mosquitoes and dengue was one of them (p < 0.0001). Use of mosquito repellents/coils, wearing clothes covering full and bed net was increased after receiving this educational intervention by ~ 20%, 11% and 6% respectively (p < 0.0001).

**Socio-economic Support**

Integrating the communities and households a socio-economic intervention was targeted to TB affected households to reduce the burden and to strengthen the TB control program to enhance TB care uptake and prevention service. Health education, community mobilisation and psychosocial support improved uptake of TB care as 97% of TB-affected households had regular visits, 71% participated in community groups, and 78% received psychosocial support service. Considering Poverty as another barrier to success of TB controlling program poverty-reduction interventions (food and ash transfer, microcredits, microloan etc.) were undertaken which engaged of 77% of the participants in these interventions. the socio-economic intervention showed marked increase in TB screening (from 82–96%); successful TB treatment completion (from 91–97%); and completion of preventive therapy (from 27–87%; all P < 0.0001) [36].

**Behavior Change Intervention**

Behavior change intervention was applied in a cluster randomized control trial conducted among children of 24 primary schools of Dhaka, Bangladesh to prevent influenza, as they are commonly linked to influenza transmission. To promote handwashing practice in low resource setting where water is scares, hand sanitizer was provided instead of water and soap to intervention schools which was regularly filled by field staff during the intervention period. Besides, hand and respiratory hygiene education was delivered through trained selected teachers regarding proper ways to cover during coughing and sneezing, and use of hand sanitizer at five key times during the day. Each of the enrolled students were provided a plastic ruler containing messages on handwashing with soap and respiratory hygiene etiquette. In addition, a video clip previously developed by icddr,b scientists based on respiratory hygiene practice was delivered during behavior change communication sessions to the students. At the end of the intervention, coughing and sneezing into open air among the students at intervention schools decreased to 37% (DID=−63%; 95% CI = − 98%, -27%). Around 18% lower incidence of influenza like illness (ILI) per 1000 student-weeks was identified among the students of intervention school than that of control school (Adjusted Incidence Rate Ratio (AIRR): 0.8, 95% CI = 0.5, 1.3, P-value = 0.4)). Around 53% of lower incidence of laboratory confirmed influenza per 1000 student-weeks was identified among students of intervention school than that of control school (Incidence Rate Ratio (IRR): 0.5, 95% CI = 0.3, 0.8; P-value = 0.01)) [37].
In another study, behavior change intervention along with vaccination was applied and compared with other only vaccinated and control group (no intervention) to assess the effectiveness of OCV vaccine in reducing incidence of severe dehydrating cholera among high risk people of age above one year and except pregnant women during 2 years after vaccination. in this cluster randomized study, a behaviour change intervention was applied along with vaccination to encourage handwashing and treatment of drinking water with chlorine by trained community health workers. to promote the use of a liquid chlorine-based treatment for household drinking water, each drinking water station included a chlorine dispenser. Overall protective effectiveness was 37% (95% CI lower bound 18%; p = 0.002) in the vaccination group and 45% (95% CI lower bound 24%; p = 0.001) in the vaccination and behavioural change group [38].

**Community Mobilization For Vector Control**

The Camino Verde (Green Way) a pesticide-free evidence-based community mobilization, was added to the conventional dengue control program in the intervention sites to test whether it enhances effectiveness in dengue prevention in Nicaragua and Mexico. In this cluster randomized control trial intervention sites followed a protocol to engage communities through a variety of events based on local vector reservoirs and community resources like puppet shows and basketball tournaments; clean up campaigns focused on unoccupied and public premises; introduction of fish into water storage containers for one year. These intervention sites participated in a community discussion of baseline evidence engaging the community leaders which helped to motivate community involvement during and beyond the study. Communities opted for a series of activities to raise awareness and to share basic knowledge on the mosquito life cycle and how to interrupt it through volunteers visit at households and schools. This multi-country community-based study, showed community mobilization to be an effective intervention for dengue vector control as household evidence of recent dengue virus infection among 3–9 years children was reduced (Relative risk reduction (RRR)-29.5, (95% CI-3.8-55.3), p < 0.05), past self-reported dengue illness decreases (RRR-24.7, 95% CI-1.8-51.2), p < 0.05), house infested with larvae or pupae (RRR-44.1, 95% CI-13.6-74.7), p < 0.001), containers with larvae or pupae (RRR-36.7, 95% CI-24.5-44.8), p < 0.001), no of pupae (RRR-51.7, 95% CI-36.2-76.1), p < 0.001) [39].

**Community-based Screening**

A quasi experimental study was undertaken to increase TB case detection by adopting an integrated intervention which included arranging chest camps for active case detection at the clinics of private non-NTP general practitioners (GPs), and on using a light-emitting diode (LED) microscope with fluorescence microscopy. Local GPs received 3 days training regarding diagnosis, recording and reporting of TB in the provincial TB control program and encouraged to refer TB presumptive cases to temporary laboratories in a nearby GP clinic. Promotional activities were assumed prior to the chest camps such as announcing through loudspeakers about the camps and free general medicine including displaying posters and banners in Urdu and in local Sindhi language. To attract the local community, health fairs were arranged that included street theatre, fun shows and stalls. This integrated intervention evident that proportion of
smear positive results was significantly higher among those from engaged private providers than among those referred from camps (OR 1.54, 95%CI 1.42–1.66). During the project, the total number of smear-positive TB notifications increased over the intervention period from 5158 to 8275 [40].

Another study was conducted among slum population of two cities, Hyderabad and Bengaluru, India, through USAID funded Tuberculosis Health Action Learning Initiative (THALI) to support them to gain access to TB services. To increase awareness among the slum population, THALI trained 112 CHWs were trained and placed in urban slums to visit and conduct activities in the slums fortnightly. They referred symptomatic TB cases to nearest center for sputum testing and also visited households with positive cases. They also supported TB patients and families with counselling, contact screening, monitoring treatment adherence, weight follow-up during visits and social scheme linkages. Their counselling also covered relevant behavior change (smoking and alcohol consumption) and referring of the TB patients to a doctor for management of adverse effects or side effects management and co-morbidities. These community-based activities through the CHWs showed increase TB detection rate in Bengaluru from 5.5 to 52.0 per 100 000 during the period, while in Hyderabad it was 35.4 initially and increased up to 118.9 per 100 000 persons. The treatment success rate was 87.1% through the intervention. Weight (OR-1.60, p < 0.05), total number of follow-up visits (OR-10.73, p < 0.001), provided TB awareness counseling (OR-2.75, p < 0.001), provided adherence counseling (OR-3.34, p < 0.001), provided nutritional counselling/support (OR-2.43, p < 0.001), provided family level counseling (OR-1.90, p < 0.05) were intriguing factors for the successful treatment outcome [41].

**Intersectional gender approaches for community-based intervention**

In this review, we have found that social determinants of health can influence the intervention outcome. Different strategies were implemented to overcome those intersecting social stratifiers to make the intervention program successful. To further investigate the interventions of included studies, we analysed them with an intersectional gender lens, focusing on how gender intersects with other social stratifiers in the intervention under analysis and how such interventions address gender intersecting inequities.

As evident in this review, Tuberculosis tends to concentrate in poor and marginalized communities where gender further intersects with other social stratifiers (age, income, employment, migration status, geographic location) and interact with wider process of social and structural systems which shape their disease experience) [36, 42]. The review finding suggests that the structural systems include social forces, economy, education system. For example, Rocha et al (2011) have shown that over-crowded living condition intersect with poverty, made them more vulnerable to Tuberculosis. Moreover, unstable employment of this vulnerable population and their experience of stigma have further shaped their access and utilization of health services. So, an integrated socio-economic and bio-medical interventions were taken into account. The project facilitated empowerment activities, including education, workshops and a mothers’ pooled child care co-operative to help women contribute to household incomes. To address poverty activities such as microcredit loans, microenterprise activities, food and cash transfer
were undertaken. Vocational training including raising animals and home-based manufacturing were provided by local organisations. Psychological support was also provided for this marginalized people facing stigmatization and depression so that they could have better access to health services [36]. Wingfield et al. (2017) have showed that socio-economic intervention through conditional cash transfer was effective in increasing access to TB treatment. Other Innovative strategies were reported by different authors [43] such as door-to-door screening for active TB in poor urban settlements to enhance their access to health service. To identify the poorest and most hard-to-reach, community leaders were involved in the intervention.

Gender, as a social determinant of health and a relational construct of power was addressed by authors as a barrier to achieve intervention outcome in prevention and control of infectious diseases [38, 44−46]. Behavior change intervention along with Oral Cholera Vaccination (OCV) was adopted in a high-risk cholera prone urban setting where over-crowded poor living condition intersect with unsafe water use and poor hygiene practice. To increase access to information cell phone messages and banners was displayed at vaccination sites including messages related to diarrhea was presented by trained volunteers. Liquid chlorine based treatment was promoted for drinking water in every household compound. To increase vaccine coverage, outreach vaccination sites were established. As a large number of participants were employed in garments and other industries, holidays and early morning mobile sessions were scheduled to reach them. As the complete vaccination coverage was more in females, author argued for future vaccination strategies for this adult male group [38].

Acute respiratory infection like pneumonia tends to develop from poor living condition, low-income, overcrowded housing condition without a safe water supply and sanitation. An intervention was targeted for mother and children to reduce episodes of illness from diarrhoea and acute respiratory infections. To involve mothers a “good mum” club was established to encourage their children for hand washing. Health education was provided through promoters through home and school visits. To encourage hand washing, free soap was distributed by field workers. To motivate hand washing practice, the children were regularly rewarded [46]. In another study, intervention was designed by analyzing how gender power relations intersect with other social determinants of health in creating differences in needs and experience [35]. To prevent and control hepatitis-B, mothers with poor income and low literacy rate from urban setting was targeted to improve immunization coverage through educating them.

As found, a range of different types and techniques of community-based intervention focusing on different diseases were extracted from the included articles. However, the details of the interventions were sparse. The community sensitization, community engagement was generally reported in the design and delivery of the implementation of the intervention package. Figure 2 synthesizes the results from the review of community–based intervention. This format was adapted from that of the complex interventions [47]. The figure displays: i) influencing factors that facilitate the or impede the effectiveness of the intervention (Box one); ii) the types of community-based intervention and their approach of engaging the community (Box two); iii) the mechanism mediating intervention (Box three); iv) Health
outcomes that were focused in the included intervention studies (Box Four); and v) factors affecting sustainability and scalability of interventions (Box five).

From this review, the influencing factors were found as facilitators were 1) Context specific intervention design; 2) Mass vaccination campaign from health system; 3) Mobile phone ownership and acceptability of receiving SMS; 4) Strong history of community engagement. On the other hand, the barriers were identified as 1) High migration of urban poor; 2) Maintaining high quality intervention for long term in large scale; 3) Low level of literacy.

The type of interventions identified in this review were Socio-economic support, Hand washing intervention, Water purification, Counselling, Mobile phone SMS reminder, Health education, Case detection and directly observed therapy (DOT) implementation, Social mobilization by community health workers, Community based screening, Nutrition supplementation, Delivery of insecticide treated material in community, Community based vector control. The approaches of community engagement were taken to deliver the mentioned interventions were found as- Community meeting, Pictorial card distribution, Household visit, Conditional cash transfer, Training to CHWs, Vocational training to community.

The mechanisms that mediating interventions were- nature of focus in intervention package, Longer duration of intervention, Teachers training and behaviour change intervention at school, Service providing during holidays and after working hour, Mobile phone SMS in local language, Maintaining self-monitoring diary, Mother- club and incentives to engage and aware mothers, Children as change agent, Mass publicity before campaign, Provision of monthly allowance to volunteer CHWs, Sharing of baseline research results with community leaders, Case detection, Vaccination coverage.

Factors affecting sustainability and scalability of interventions are: mainstreaming of the community health workers, strong community engagement, operational integration with local administration, and Continuous communication and interaction between governmental agencies and communities.

Discussion

This review reported an overview of the effectiveness of approaches to reduce and control communicable disease arising in poor urban areas in LMICs. The SDOH intervention and mechanism figure describes a conceptual feature of complex social intervention as a perspective where the macro-context (social and economic structure, culture) that need to be considered to identify the facilitating and challenging factors. In addition, the nature of intervention and process of engaging community have also been identified that can help designing the future intervention in this area. The figure also showed that interventions directed at different levels as a package therefore necessary for obtaining desired results.

Across the included articles it was observed that the community-based interventions have the potential to substantially reduce the disease incidence among the urban poor communities. Previous evidence from across the globe is also congruent with this finding. For example, a study conducted by Kidane G et al [48] in Ethiopia revealed that child mortality caused by holoendemic malaria can significantly reduce by
providing peer training intervention to the mothers. The review also identified the importance of shared leadership and proper engagement of the community from the initial stage of the intervention.

The major strength of this review was this was one of the first systematic reviews that attempted to explore the effectiveness of communicable disease reduction related interventions which implemented in urban areas of LMICS. The strength of this review is it adopted robust methods so that errors and bias can be minimized. All the major electronic database and key websites were systematically searched in a comprehensive manner for identifying and including relevant studies. Besides additional search was conducted among the included studies for checking references with an aim to include relevant studies. We included Randomized Control Trial and quasi experimental trials to capture varieties of intervention provided for prevention and control of communicable diseases in urban poor setting. Study quality were systematically assessed following a standard quality assessment checklist as per the Cochrane Handbook for Systematic Reviews of Interventions. Nearly half of the included studies were of medium to high quality.

However, it was difficult to pin-point effectiveness of any single SDOH component working towards making a significant change in any health outcome. This was because the interventions taken were complex and designed with multi component along with variations in social settings. Besides, we cannot conduct meta-analysis since there was absence of studies with homogeneous intervention package and effect size estimation. This systematic review was limited to studies published in the English language only. However, there could be rich evidence published in other languages.

In view of the evidence from this review it was difficult to say whether a single social determent of health was more important than other across different setting. Based on the context, different SDOH can play different role. Therefore, the intervention components need to tailor-made in line with the context. Evidences pointed out that interventions were most likely to be effective when designed with a package of components. From this perspective following are the key points: Contextualized intervention components; Education for all; Stakeholder participation; Gender friendly intervention; Investment in infrastructure development; Support service; Methodological issues; and Need more studies with robust design

This review provided overview on effectiveness of wide ranges of community-based interventions with different types of approaches for a number of communicable diseases in urban poor areas in LMICs. It was observed that the articles that reported statistically non-significant outcomes were linked with short duration of intervention, small sample size, large attrition effect. Given the complexity of community-based intervention, short-term intervention might not be efficient to reduce and control the communicable disease in an instant manner. Therefore, the evidence could be suggestive of an intervention model to try out in other contexts. Despite these limitations, some studies showed some promising results in terms of changing hospitalization rate, and disease incidence rate as well as changed attitude, behaviour. Besides from gender perspective some of the studies also take an inclusive approach to include women. The
review did not find any stand-alone community-based intervention approach to prevent and control communicable disease.

This review and its analysis drew conclusions from multiple studies that include randomized and quasi experimental design. Besides the included studies have diversified context in terms of setting and population. Most of the studies came from Asia and Latin America with a few from African region. The review shows that that more large-scale, high-quality research are essential to provide further evidence about the effect of certain community-based interventions.

**Conclusion**

Community-based intervention requires multi-level interaction among wide range of stakeholders and hence its effectiveness also depends upon the complex interaction. The success and failure of any approach thus does not depend only on methodological approaches, but also on the context, persons and time elements of the macro social circumstances. From this perspective this review is suggestive of co-creating the intervention package with community members so that community ownership and community leadership is ensuring in the intervention implementation.

Regarding future scale up, the included studies did not provide much description. From this context, future research should also focus on appropriate outcome measures and to include process indicators so that implementation challenges can be identified for future scaling up. Controlling and preventing communicable disease in urban poor areas necessitates comprehensive approach with the participation of all relevant stakeholders so that long term sustainability can be ensured.

**Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CASP</td>
<td>Critical Appraisal Skills Programme</td>
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<tr>
<td>CHW</td>
<td>Community Health Workers</td>
</tr>
<tr>
<td>icddr,b</td>
<td>International Centre for Diarrhoeal Disease Research, Bangladesh</td>
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<tr>
<td>INGO</td>
<td>International Non-Governmental Organization</td>
</tr>
<tr>
<td>LMICs</td>
<td>Low- and Middle-Income Countries</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
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<td>RCT</td>
<td>Randomized Control Trial</td>
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<td>SDOH</td>
<td>Social Determinants of Health</td>
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<tr>
<td>WHO-TDR</td>
<td>World Health Organization (WHO), Special Programme for Research and Training in Tropical Diseases (TDR)</td>
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Declarations

Ethics approval and consent to participate

For conducting this systematic review ethical approval was not required since we identified and synthesized information from already published material available via online database to answer the research question. Regarding the consultation with experts and relevant researchers we did collect any personal information that requires ethical approval.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

SS conceptualized the study, oversaw the search and conducted analysis/synthesis and led the drafting of the first draft of the review. DSB played a leading role in literature screening and conducted analysis. IN, FS, GKD participated in the development of search strategy and contributed to drafting of the first draft of the full review. RI worked on statistical analysis and other relevant methods of data analysis. MODB and DDR reviewed and provided feedback on the final manuscript.

Disclaimer

The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

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References


Table 1

Table 1 is available in Supplementary Files section.
Figures

Figure 1. PRISMA flow diagram of study selection process

Figure 1
See image above for figure legend
Figure 2. Synthesis of community-based interventions to prevent or control communicable diseases in urban informal settlements in LMICs (Modified from Quesa et al., 2020) [47]

Figure 2

See image above for figure legend

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.
- Table1.pdf